Babine Watershed Monitoring Trust

2014 Annual Monitoring Plan

FINAL

Babine Watershed Monitoring Trust
Smithers, BC V0J 2N0

www.babinetrust.ca

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1. Introduction

The Babine Watershed Monitoring Trust (BWMT) is directed through its Trust Agreement Document to be responsible for "*planning, prioritising, directing, facilitating and funding impartial monitoring research of the implementation and effectiveness of public land use plans and related natural resources management activities in the Babine Watershed*"; and "*providing credible monitoring research results as part of a formal rigorous adaptive management process that enables continuous improvement of public land use plans resulting in better management of environmental values in the Babine Watershed.*"

This document constitutes the 2014 Annual Monitoring Plan (AMP) for the Babine Watershed Monitoring Trust, which the Trustees are required to produce under Section 10.2 and Schedule C of the BWMT Agreement. The first Annual Monitoring Plan was approved by the BWMT in July of 2005. Since then, AMPs have been completed annually. Each year, some planned projects have not been completed and have carried over to subsequent years for a variety of reasons. These projects remain a priority of the BWMT, and appear in subsequent AMPs.

The 2014 AMP sets out the year's budget, lists high-priority monitoring projects, describes projects approved for direct funding, and identifies topics requiring additional funding. The plan provides a synopsis and rationale for each approved project. The BWMT allocates funds to monitoring projects using the process for determining priorities and costs prescribed in the BWMT Agreement and described in the Babine Watershed Monitoring Framework (see www.babinetrust.ca).

2. Budget

The funds available from the Babine Watershed Monitoring Trust Revenue Trust Account (BWMT Agreement, Section 3.1.3) are set out in Table 1. The BWMT will receive a private donation by March 2014 with a total value of $30,000, and has received over $300 in other donations. These funds are available to directly support the 2014 AMP. There is no longer matching funding available from the provincial government. There are also funds carried over from 2013—unallocated or project surpluses.

Table 1. Budget for 2014.

	Contributed	Available under the 2:1 private/public ratio rule	Funds Available to be Distributed	Banked for 2014
Revenue Trust Account				
Private donations expected 2014	$30,000.00	$30,000.00		
Donations 2013	$300.00	$300.00		
Levered funds: 2013	$0.00	$0.00		
BC gov't – remaining funds	$0.00	$0.00		
Revenue Trust Account Funds Available		**$30,300.00**	**$30,300.00**	
Other Funds				
Banked Funds from 2013			$76.16	
Interest Income 2013			$144.18	
Operating Fund Expenses			-$31.65	
Other Funds Available			**$188.69**	
Money Returned				
Project Money Returned – BVRC 2013			$1,938.23	
Other Project Money Returned			$0.00	
Total Money Returned			***$1,938.23***	
Total Funds Available			**$32,426.92**	
Expenses				
Administrative & Technical Support			($12,000)	
New Projects 2014 (2 projects)			($20,000)	
Total Expenses			***($32,000)***	
Funds Available minus Expenses			***$426.92***	***$426.92***

3. Monitoring Priorities

The Trust supports monitoring projects, maintains the Babine Watershed Monitoring Framework and administers the monitoring program.

The Monitoring Priority Tables generated by the Monitoring Framework show priorities and associated costs for the following types of monitoring:

1. collecting indicator data (implementation monitoring),
2. monitoring to improve knowledge and reduce uncertainty (validation monitoring/research),
3. monitoring to detect negative consequences (effectiveness monitoring).

Appendix 1 summarises funding decisions for high-priority monitoring topics in each of the three types. The order within each list indicates relative priority assigned by the Monitoring Framework as updated in 2010. The tables also provide a brief rationale for each funding decision. Not all topics can be funded. Higher-priority topics will usually be funded preferentially. When a lower-priority topic is selected for funding, a rationale is provided as to why the higher-priority topics were not chosen. All non-funded topics lower on ranked lists are not funded because of insufficient funds.

The Priority Tables also note objectives that cannot be monitored because targets are lacking (Appendix 3). Government has been advised that it needs to amend land-use plans to include measurable targets so the BWMT can monitor these objectives, but progress is slow.

4. Approved Monitoring Projects for 2014

4.1 Ongoing Projects from Previous Years

Four projects will be completed by March 31, 2014: three are complete and awaiting final invoicing; one is awaiting final report and presentation (Table 2). The Wilderness Value project (2006-3) was delayed due to the failure of the sockeye run in 2013. The Water Quality project (2012-3) and Water Quality: stream temperature and glaciers project (2013-1) have been combined in a proposal to the Sustainable Forests Initiative for matching funding and hence will not begin until 2014 (Table 2).

Table 2. Ongoing projects from previous years (values to nearest $).

Project Number	Title	Status	Remaining Funding Committed
2006-3	Wilderness Value of Babine River Corridor	Delayed until 2014	$10,626
2008-1	Update Knowledge Base	Ongoing	$1,297
2009-A3	Funding Solicitation	Ongoing	$643
2010-1	Timing of Industrial Activities	Will be completed by March 31, 2014	$1,055
2010-A3	Data Management	Support to March 2013	$1,799
2012-2	Indicator Summaries	Complete: awaiting invoice	$328
2012-3	Water Quality	Phase III combined with 2013-1: will begin 2014	$20,047
2013-1	Water Quality: stream temperature and glaciers	Combined with 2012-3: will begin 2014	$20,000
2013-2	Biodiversity Effectiveness Monitoring Design	Complete: awaiting invoice	$5,000
2013-3	Grizzly Bear – Human Monitoring Design	Complete: awaiting invoice	$2,000
2013-4	Update Monitoring Framework	Ongoing	$2,500
2013-5	Website	Ongoing	$475
Total			**$65,770**

4.2 New Projects

The allocation of available funds for this year is shown in Table 3. Two new monitoring projects are approved for full funding by the BWMT in 2014. These two projects follow from design projects completed in 2013. One, in collaboration with BC Parks and designed in project 2013-3, will monitor grizzly bears. The second, designed in project 2013-2, will complete Phase 1 of a study of stand-level biodiversity. Funds are also approved for ongoing administrative and technical support.

Table 3. Approved projects for 2014. "A" designates administrative and technical support (nearest $).

Activity	Project Number	Title	Funding Committed	% of Total
New projects	2014-1	Grizzly Bear DNA Hair Snare	$10,000	31
	2014-2	Biodiversity Effectiveness Monitoring: Phase 1	$10,000	31
Project support	2013-A1	Technical Support	$8,500	27
	2013-A2	Administrative Support	$3,500	11
Total			**$32,000**	

Project costs form 62% of new expenditures for 2014; support costs form the remaining 38%. Total expected expenditures for 2014 are $65,770 for ongoing projects plus $32,000 for new projects. Support costs form 12% of this combined total in 2014.

New and ongoing projects are described in the following synopses. Synopses for completed projects are included in Appendix 2 until the results have been incorporated into the Knowledge Base and included in other processes (e.g. BWMT Plan Amendment Process and Criteria), at which point the project summaries are included in a BWMT 5-year Activity Report. Subsections listing consequences for the Knowledge Base and consequences for management summarise actions precipitated by each project.

5. New Project Synopses 2014

Project 2014-1: Grizzly Bear DNA Hair Snare

Abstract:

This project will use hair-snag DNA sampling to provide knowledge that will help monitor the effects of grizzly bear–human interactions at the Babine River Corridor Park entrance. Selection of this project follows from recommendations made in Project 2013-3: Grizzly bear/human behaviour monitoring design.

Many factors influence risks to people and grizzly bears near the southern entrance of the park. People and bears overlap over about a 1 km^2 area including a Department of Fisheries and Oceans fish counting fence, seasonal residence for personnel, boat launch, and parking lot; a BC Parks parking lot; and a Forest Service Road mainline including a bridge across the Babine River with a walkway used by bear viewers. Because of the presence of various attractants and the overlap between people and bears in a largely unmanaged context, grizzly bear experts concluded that, in a sub-unit centred on the fish fence, the combination of risk factors was extreme and the situation unsustainable from a grizzly bear management perspective (Project 2012-1: Collaborative Grizzly Bear Workshop). A major concern was female mortality related to human–bear interactions. This area is potentially an attractive sink; that is, risk of bear mortality increases due to the availability of attractants and behaviours learned by bears in this area.

Hair-snag DNA sampling can determine the number of bears that use the area and can determine sex, genetic variability and potentially relatedness. The data can also be used to identify bears that use this area and are subsequently killed by people. Analysis of stable isotopes could potentially provide useful information on diet (e.g., fish, anthropogenic foods, berries).

A local-scale hair-snag DNA project would be a particularly useful contribution to a local-scale population trend initiative and to population-scale status and trend initiatives. The Babine Grizzly Bear Population Unit has been identified among the highest priorities in the Skeena Region for inventory and monitoring using hair-snag DNA sampling methods. While there is a need for, and interest in, completing such initiatives, there is currently no government commitment for their completion.

This project will design and deliver the first year of a study to monitor trends in grizzly bear use of an area that includes the area of overlap between people and bears. The project will also be designed to inform a population-scale project to determine home range size, level of risk to the population, and local population density. Preliminary input suggests that this project should be centred at the fish counting fence, encompassing 40 km length of the Babine River-Nilkitkwa Lake-Babine Lake system, using 5 km x 5 km grids, and an appropriate width. As a minimum, this project will report bear species identified (i.e., grizzly bear, black bear); individual grizzly bears and their sex and relatedness (as feasible); and genetic variability (heterozygosity) index for bears sampled. These data should be presented within the context of bear use and movements within the park entrance area, the broader surrounding area, and between areas. Stable isotope analysis quantifying use of major food types, including anthropogenic foods, would be useful but it is a lower priority. The project will arrange to bank genetic material with the Province of BC, as feasible, to identify bears sampled in this project that are later sampled through grizzly bear management activities (e.g., compulsory inspections, problem wildlife occurrence reports, research) and to conduct isotope analysis (if not completed for this project) or any other analyses that may be of interest.

The project will use methods that appropriately manage and address human safety concerns; for example, use of bait and other attractants may not be appropriate in areas where people

and bears can be anticipated to overlap, spatially and temporally, and considerations may be needed for use of barbed wire in areas that can be anticipated to be used by people.

This project will continue building a collaborative relationship with BC Parks, Conservation Officer Service and Fish and Wildlife Branch to support project completion and provide a foundation for future work. Relationships will also be established with the Department of Fisheries and Oceans and Lake Babine Nation to gather their support for this project.

Status: Initiated in 2014.

Geographic scope: Southern park entrance to Babine River Corridor Park and other selected localised areas with high bear and human use.

Objectives listed in land-use plans: Objectives to maintain grizzly bears are included in all land-use plans.

Type of monitoring: Reducing uncertainty

Potential leaders: To be determined through Request for Proposal process.

Potential partners: BC Parks. Darren Fillier with BC Parks is pursuing additional funding for this project from the Park Enhancement Fund in April/May.

Funding: $10,000 (including GST).

Consequence for knowledge base: This project will gather information on grizzly bear identity and use of the park entrance that will help determine effectiveness of management strategies.

Consequence for management: This project will support management decisions, through appropriate processes which are separate from the BWMT, by showing the level of risk and uncertainty associated with strategies to maintain grizzly bears. It may increase confidence in current activities, suggest further monitoring projects or lead to initiation of a plan-amendment process.

Project 2014-2: Biodiversity effectiveness: phase 1

Abstract:

This project follows recommendations from two previous BWMT projects. Project 2013-2 (biodiversity effectiveness monitoring design) recommended a focus on stand-level structural retention and tree species retention; project 2012-2 (indicator summary) noted a need for further investigation into deciduous retention. Hence, this project will investigate the effectiveness of post-harvest retention of deciduous trees and structure at maintaining biodiversity.

Phase 1 will analyse existing data and conduct interviews to determine intended levels of deciduous and structural retention. It will select and field-check an appropriate set of sample sites for investigation, considering sites monitoring in previous BWMT stand-structure projects. It will complete design of an effectiveness study to gather data on tree species, structure, epiphytic lichen community (via litter pick-up) and breeding bird community. If time and funding permit, it will include the start of sampling.

Status: Initiated in 2014.

Geographic scope: To be determined through the project within the Babine Watershed.

Objectives listed in land-use plans: Land-use plans include objectives to maintain biodiversity.

Type of monitoring: Effectiveness monitoring

Potential leaders: To be determined through Expression of Interest process

Potential partners: To be determined

Funding: $10,000 (including GST). Intent is for further funding in 2015 to continue the project.

Consequence for knowledge base: This project will design and conduct an effectiveness monitoring project.

Consequence for management: This project will support management decisions, through appropriate processes which are separate from the BWMT, by assessing the effectiveness of strategies designed to maintain stand-level biodiversity. It may increase confidence in current activities, suggest further monitoring projects or lead to initiation of a plan-amendment process.

6. Ongoing Project Synopses

Project 2013-1: Water quality: temperature and climate change

Abstract:

This project examines two elements of water quality: water temperature as impacted by cumulative effects of development and climate change, and impacts on hydrology related to loss of glaciers with climate change. Harvesting wet ecosystems can lead to increased stream temperature even with riparian corridors. Ditches along road networks can lead to substantially increased water temperature because the water moves slowly. The Shedin and Nilkitkwa sub-basins in particular may have concerns for temperature due to the amount of harvesting. Bull trout and spawning salmon are sensitive to temperature.

The first phase of the stream temperature element is an office exercise, overlaying road networks and harvested wet ecosystems with sensitive fish habitat, and determining priority locations for field monitoring. The second phase includes field measurements of temperature in selected road ditches linked to stream systems at mid-day in July.

The project also includes a preliminary investigation into glacier status in northern Babine systems, determining trends in glaciers and predicting risk to Babine water quality due to climate change. As ice and snow melt in spring, sediment from on top enters water system and decreases quality. As temperature increases in summer, melting from glaciers adds further input. Streams clear in fall. Small streams can be clear water refugia during high-sediment periods. An important question to consider is "what is climate change doing to the glaciers and how will changes impact water systems in the Babine". Studying present and forecast glacier condition could decrease uncertainty.

Status: Initiated in 2013. Combined with project 2012-3 in an application for funding from the Sustainable Forests Initiative in 2014 in collaboration with BCTS, MFLNRO and PIR.

Geographic scope: Stream temperature in Nilkitkwa and Shedin sub-basins; glacier status in Nilkitkwa and other northern Babine systems.

Objectives listed in land-use plans: Land-use plans include a goal to maintain water quality, but focus indicators on those dealing with sedimentation. Thus, there is uncertainty about whether achieving the objectives will achieve the goal.

Type of monitoring: Reducing uncertainty

Potential leaders: To be determined through Request for Proposal process.

Potential partners: Ian Smith (BCTS), Dave Wilford (hydrologist, MFLNRO) and Matt Sakals (geomorphologist MFLNRO) proposed the project as a priority for the Babine. Brian Menounos is a glacial geomorphologist at UNBC.

Funding: $20,000 (including GST)

Consequence for knowledge base: This project will gather information on important water quality indicators that are not currently included within the knowledge base and will allow an assessment of risk to water quality associated with these indicators.

Consequence for management: This project will support management decisions, through appropriate processes which are separate from the BWMT, by showing the level of risk and uncertainty associated with strategies to maintain water quality. It may increase confidence in current activities, suggest further monitoring projects or lead to initiation of a plan-amendment process.

Project 2013-2: Biodiversity effectiveness monitoring design

Abstract:

This project will review literature and propose methodology to monitor the effectiveness at maintaining biodiversity of a) stand-level retention of various structures, b) retention of natural tree species and c) landscape-level connectivity of mature and old forest in corridors. The project will list appropriate indicators (i.e. sensitive to change, easy to monitor) and provide appropriate study design.

The monitoring must be achievable within BWMT's budget (e.g. $20,000/year for two years), or must propose collaboration to increase the budget. A table of options and costs would be useful.

Status: Initiated in 2013. Final presentation given March 2014. Awaiting final report.

Geographic scope: Babine Watershed.

Objectives listed in land-use plans: Land-use plans include objectives to maintain biodiversity.

Type of monitoring: Design of effectiveness monitoring

Contractor: Megan D'Arcy

Funding: $5,000 (including GST)

Consequence for knowledge base: This project will design an effectiveness monitoring project for implementation.

Consequence for management: This project will suggest further monitoring projects.

Project 2013-3: Grizzly bear-human behaviour monitoring design

Abstract:

This project collaborated with BC Parks and reviewed potential methods for monitoring the effectiveness of strategies to minimise bear-human interaction around Babine River Park.

Many factors influence risks to people and grizzly bears near the southern entrance of the park. People and bears overlap over about a 1 km^2 area including a Department of Fisheries and Oceans fish counting fence, seasonal residence for personnel, boat launch, and parking lot; a BC Parks parking lot; and a Forest Service Road mainline including a bridge across the Babine River with a walkway used by bear viewers. Because of the presence of various attractants and the overlap between people and bears in a largely unmanaged context, grizzly bear experts concluded that, in a sub-unit centred on the fish fence, the combination of risk factors was extreme and the situation unsustainable from a grizzly bear management perspective (Project 2012-1: Collaborative Grizzly Bear Workshop). A major concern was female mortality related to undesirable human–bear interactions. This area is potentially an attractive sink; that is, risk of bear mortality increases due to the availability of attractants and behaviours learned by bears in this area.

The project considered five methods:

1. Problem-solving process based on policy sciences
2. Hair-snag DNA sampling
3. Observational studies based on the design completed (but not implemented) for BC Parks in 2007
4. Bear-human information management system
5. Hair cortisol concentration

BWMT trustees considered the options with the contractor. The most recommended option (1) was rejected as not falling within BWMT's mandate. The next most highly recommended option (2) was accepted to monitor bear identity and use of the focal area. A local-scale hair-snag DNA project would be a particularly useful contribution to a local-scale population trend initiative and to population-scale status and trend initiatives. The Babine Grizzly Bear Population Unit has been identified among the highest priorities in the Skeena Region for inventory and monitoring using hair-snag DNA sampling methods. While there is a need for, and interest in, completing such initiatives, there is currently no commitment for their completion.

Status: Initiated in 2013, following from project 2012-1. Final presentation and draft report completed March 2014. Awaiting final report.

Geographic scope: Babine River Corridor Park entrance area.

Objectives listed in land-use plans: Objectives to maintain grizzly bears are included in all land-use plans.

Type of monitoring: Designing implementation and effectiveness monitoring.

Contractor: Debbie Wellwood, Raven Ecological Services

Partner: BC Parks

Funding: $2,000 (including GST)

Consequence for knowledge base: This project will design a monitoring program.

Consequence for management: This project will suggest further monitoring projects.

Project 2013-4: Update Monitoring Framework

Abstract:

This project collaborates with Glen Buhr of MFLNRO as described in communications between Glen and BWMT. The goal of the project is to strengthen the strategic-level relationship between BWMT and the District in order to take advantage of synergies, avoid duplication of efforts and generally improve the effectiveness of monitoring.

BWMT is required to monitor the results and strategies of Forest Stewardship Plans (FSPs) within the Babine River Watershed. To monitor the effectiveness of these strategies requires that they are added to the monitoring framework, and that the risk curves take into consideration implications of implementing approved FSP results and strategies within the Babine Watershed. This year's work would determine whether any of the newly included strategies are high priorities for monitoring.

Status: Initiated in 2013.

Geographic scope: Babine Watershed.

Objectives listed in land-use plans: All objectives listed within FSPs.

Type of monitoring: All types

Project leader: Karen Price

Partner: Glen Buhr (MFLNRO)

Funding: $2,000 (including GST). Funds taken from project 2008-1 (Update Knowledge Base).

Consequence for knowledge base: This project will update the framework and the knowledge base.

Consequence for management: This project will suggest further monitoring projects.

Project 2012-3: Water quality

Abstract:

This project has three phases, with each phase being dependent upon successful completion of previous phases:

- Phase I gathered information. Because land-use plans focus on sedimentation rather than including, for example, stream temperature or point-source chemical contamination, there is uncertainty about whether the indicators included in the plans will maintain water quality. This phase confirmed that BWMT can monitor indicators not currently listed in land-use plans, investigated existing information, and determined priorities for a more comprehensive list of indicators of water quality, based on a meeting with Dave Wilford and Matt Sakals. One priority (looking at sedimentation issues at road crossings) will be covered by Project 2012-3; another will be included in new project 2013-1. (Note that these projects have subsequently been combined.)
- Phase II selected two priority sub-basins—Gail and Shedin—for examining road crossings. Gail Creek has potential issues, including slumps and unpulled culverts, at road crossings. Gentle over steep terrain is common. Shedin has an alluvial fan with erosional issues.
- Phase III will use a Stream Crossing Quality Indicator to assess the hazard of sedimentation to water quality in Gail and Shedin sub-basins. This project repeats the sampling completed for sub-basins in the Bulkley. The Kispiox portion of the Babine has more relief, and more fragile sediments, than the sub-basins BWMT has previously studied.

Status: Initiated in 2012. Phases I and II completed. Phase III initiated in 2013. Phase III combined with project 2012-3 in 2014 in an application for funding from the Sustainable Forests Initiative in collaboration with BCTS, MFLNRO and PIR.

Geographic scope: Gail and Shedin sub-basins.

Objectives listed in land-use plans: Land-use plans include a goal to maintain water quality, and focus on sedimentation indicators.

Type of monitoring: Reducing uncertainty

Potential leaders: To be determined through Request for Proposal process for Phase III.

Potential partners: Ian Smith (BCTS), Dave Wilford (hydrologist, MFLNRO), Glen Buhr (District Stewardship MFLNRO), Al Harrison (engineering technician for BCTS in Hazelton)

Funding: $20,000 (before HST) for all three phases.

Consequence for knowledge base: Phase I will determine appropriate water quality indicators. Phases II and III will gather information on a priority indicator.

Consequence for management: This project will support management decisions, through appropriate processes which are separate from the BWMT, by showing the level of risk and uncertainty associated with strategies to maintain water quality. It may increase confidence in current activities, suggest further monitoring projects or lead to initiation of a plan-amendment process.

Project 2010-1: Industrial Activity Timing

Abstract:

This project will collect information on the timing of industrial activities in relation to mountain goats, grizzly bears and recreation. Industrial activities investigated will include all stages of forest management, including road building, harvesting and silviculture, as well and mining and exploration.

For mountain goats, the project will determine the proportion of industrial activities within 200 m and 500 m of goat habitat during the natal period (April 15 – July 15). It will also determine activities in this zone during winter (October to March), because Project 2008-3 noted that winter activity should also be an indicator. For minimising disruption to grizzly bears, hibernation is the timing variable of interest. Because bears are active throughout October, the project will determine the proportion of industrial activity in mapped grizzly bear zones from November to March. For wilderness value, the project will determine the proportion of industrial activity within the Babine River Special Management Zone from November to March (winter) and from August to October (peak tourism period).

This project will query existing databases (e.g. RESULTS), and interview knowledgeable people as necessary.

Status: Initiated in 2010. Anticipated completion by March 31, 2014.

Geographic scope: Babine watershed.

Objectives listed in land-use plans: The Bulkley LUPs have a strategy to avoid harvesting near mountain goat habitat during the natal period. The Kispiox SRMP and Babine LUP have strategies to harvest during winter in various zones to minimise disruption to grizzly bears and to maintain wilderness value in Babine River Corridor Park. Bulkley LUPs have strategies to harvest in winter to protect connectivity in landscape riparian corridors.

Type of monitoring: Collecting implementation data.

Contractors: Deborah Cichowski and Johanna Pfalz

Potential partners: PIR may be able to provide in-kind assistance.

Funding: $4,000 (before HST)

Consequence for knowledge base: This project will collect implementation data to allow for risk assessment.

Consequence for management: This project will enable better management decisions to be made, through appropriate processes which are separate from the BWMT, by showing the level of risk and uncertainty associated with current timing of industrial activities. It may increase confidence in current activities, suggest further monitoring projects or lead to initiation of a plan-amendment process.

Project 2010-A3: Data Management

Abstract:

This project will develop and implement a process to gather, maintain and access spatial information. Funding covers hardware and fees for a Data Administrator to complete the following tasks:

- provide the necessary hardware,
- develop an appropriate data management model,
- document standards for GIS data for use with BWMT projects,
- locate and load existing BWMT data from previous years, and
- load data from projects completed this year.

The project is based on the description of Phase I presented to the BWMT, as requested, by Johanna Pfalz in October, 2009.

Status: Initiated in 2010; contract let 2011. Continuing to March 31, 2014.

Geographic scope: Babine watershed.

Objectives listed in land-use plans: Not applicable

Type of monitoring: All

Contractor: Johanna Pfalz

Potential partners: Consideration of partners will occur in future Phases.

Funding: $2,690 for set-up and loading existing data. A maximum of $3,310 further will be available for ongoing administration over the year (it is anticipated that this cost will be lower than projected). Total budget: $6,000 (before HST). Budget to continue project: additional $3,000 (before HST).

Consequence for knowledge base: This project will track spatial data for BWMT projects, increasing efficiency for future projects and facilitating updates.

Consequence for management: Not applicable.

Project 2005-4 / 2006-3: Wilderness Value of Babine River Corridor

Abstract:

This project has three phases, two of which were supported by funds released in 2011. The final phase was approved in 2013, but was delayed due to the low sockeye salmon return that year.

Phase 1 explored methodologies, including new approaches based on social networking, used to assess public perception of wilderness value and socially acceptable levels of sustainable use in a non-biased manner. Phase II developed a specific approach for the Babine River Corridor, targeted at the complete suite of interest groups. The approach considered sustainable use in the Natural Environment and Wilderness Recreation Zones of Babine River Corridor Park, and perceptions of auditory disturbance throughout the Park.

Phase III will implement the approach.

Status: Initial methodology designed in 2005/2006, but did not meet the requirements of the BWMT. Funding was deferred to allow completion and implementation of the Babine River Corridor Management Plan by BC Parks, of the Quality Waters Strategy and Angling Management Plan and a subsequent risk analysis of new strategies. Park Management Plan will now not be completed in the foreseeable future; hence funds released for Phase I and II in 2011. Phase I and II completed by March 31, 2013. Phase III delayed until 2014 due to the failure of the sockeye salmon fishery in 2013.

Geographic scope: Babine River Corridor Park

Objectives listed in land-use plans: The Babine River Corridor Park Management Direction Statement includes an objective to maintain a wilderness experience in the corridor, including a sustainable level of recreation. The Kispiox SRMP includes an objective to maintain the aesthetic quality (visual and auditory) of the Babine River Corridor.

Type of monitoring: Detecting negative consequences (sustainable use); reducing uncertainty (auditory disturbance).

Contractor: Megan D'Arcy and Ruth Lloyd (2012). John Shultis, University of Northern BC (2005).

Partners: 2005 phase: Real Estate Foundation Partnering Fund (provided matching funds; 2005), ILMB (provided logistic support).

Potential partners: BC Parks (Brandin Schultz) current phase.

Funding: $5,000 in 2005 (completed); $15,000 (before HST) budgeted in 2006, deferred to future years. $5,000 (before HST) of the $15,000 released for Phases I and II in 2011; the remainder released in 2013.

Consequence for knowledge base: This project constitutes the first step in detecting negative consequences to sustainable use and wilderness value of the Babine River Corridor.

Consequence for management: This project will enable better management decisions to be made, through appropriate processes which are separate from the BWMT, by determining levels of sustainable use in various zones of Babine River Corridor Park. It may increase confidence in current activities, suggest further monitoring projects or provide input to further development of strategies in Babine River Corridor Park, through amendment of the Management Direction Statement or eventual development of a full Park Management Plan.

7. Administration

Project 2014-A1: Technical support

Abstract:

Continuity of technical support is necessary for effective and efficient management of the monitoring framework, and the BWMT in general. Karen Price will provide technical support to the BV Research Centre and the BWMT as needed. Tasks include

- advise BWMT as necessary on Monitoring Framework
- prepare agenda, facilitate meetings and provide minutes
- communicate with BV Research Centre
- present monitoring priorities (as resulting from Monitoring Framework) to BWMT
    - provide initial description of projects and cost estimates
    - facilitate discussion in relation to project selection
- write draft AMP and revise based on BWMT comments
- prepare calls for proposals
- liaise with contractors to ensure that projects meet needs of framework and BWMT
    - meet to confirm project design
    - discuss project as necessary
    - review and edit report
    - supervise summary of study to ensure that it allows Knowledge Base to be updated, and describes consequences for the Knowledge Base, for management and for future monitoring
- communicate project status to BWMT as necessary

Status: Initiated in 2007; division between administration and technical support revised in 2009 and 2010. Administered by Bulkley Valley Research Centre.

Geographic scope: Not applicable

Objectives listed in land-use plans: Not applicable

Type of monitoring: Not applicable

Contractor: Karen Price

Potential partners: Bulkley Valley Research Centre

Funding: $8,500 (including GST)

Consequence for knowledge base: Not applicable

Consequence for management: Not applicable

Project 2014-A2: Administrative Support

Abstract:

The Bulkley Valley Research Centre provides administrative support in the form of contract management, meeting facilities and support, website maintenance, and communications. Tasks include

- maintain independent financial records
- manage contracts
    - post calls for proposals
    - select contractor
    - prepare and implement contract
    - oversee contracts to ensure quality and timeliness of reporting
- add documents to website.

Please see contract schedules for further information.

Status: Ongoing since 2005; division between technical support and administration revised 2009 and 2010.

Geographic scope: Not applicable

Objectives listed in land-use plans: Not applicable

Type of monitoring: Not applicable

Contractor: Bulkley Valley Research Centre

Funding: $3,500.00. Taxes are not charged.

Consequence for knowledge base: Not applicable

Consequence for management: Not applicable

Project 2009-A3: Funding Solicitation

Abstract:

The BWMT needs to broaden its funding base, especially if existing sources of private and government funds decline.

BWMT developed a communications strategy in 2013. The BWMT website, brochure and poster are important elements of this strategy. In 2013, funds were directed to project 2013-5 (Update BWMT website).

In 2014, a project was initiated to place fundraising inserts into two angling magazines.

Status: Initiated 2008.

Geographic scope: Not applicable

Objectives listed in land-use plans: Not applicable

Type of monitoring: Not applicable

Contractor: To be determined in consultation with Bulkley Valley Research Centre

Potential partners: Bulkley Valley Research Centre, Government ministries (particularly MFLNRO and MoE)

Funding: $2,000 (2009); $1,250 (2008); total $3,250 (before HST)

Consequence for knowledge base: Not applicable

Consequence for management: Not applicable

Appendix 1: Decision Tables

Appendix 1 summarises funding decisions for high-priority topics in three types of monitoring:

- Table A1 (p. 21) **Collect Indicator Data** (Implementation Monitoring)
- Table A2 (p. 23) **Improve Knowledge and Reduce Uncertainty** (Validation Monitoring/Research)
- Table A3 (p. 24) **Detect Negative Consequences** (Effectiveness Monitoring).

Table A 1 Collect Indicator Data (Implementation Monitoring).

Funding decisions for high priority topics for collecting indicator data. Topics for this 5-year period are ordered by relative priority as determined by Monitoring Framework[4]. Shaded projects are completed, ongoing or planned for 2014.

Objective	Indicator	History	Project #	Project name	Funding	Project length	2014 Status	Rationale
Fish habitat	% of natural riparian habitat	Funded 2005	2005-1	Riparian ecosystems	$15,000	1 year	Complete for Nichyeskwa.	Low priority in other watersheds
Riparian biodiversity	% of natural riparian habitat	Funded 2005	2005-1	Riparian ecosystems	as above	1 year	Complete for Nichyeskwa.	As above
Rare ecosystems	% of natural	Funded 2009, 2010	2009-1	Rare ecosystems: phase I and II	$10,551	2 years	Complete	
Steelhead	Repeated capture	Not funded	—	—	—	—	—	Too expensive to do well
Human/bear interaction	Screening	Not funded	—	—	—	—	—	Low priority based on grizzly workshop (2012-1).
Human/bear interaction	Education	Funded 2009	2009-2	Human/grizzly bear interaction and education: baseline data	$10,551	1 year for baseline	Complete	
Water quality	Stream crossing: Kispiox	Assessment funded 2012	2012-3	Water quality	$21,102 (part)	—	Ongoing	
Water quality	Landslides	Assessment funded 2012	2008-1 (part); 2012-3	Water quality	$250 in 2008; $21,102(part) in 2012	—	Ongoing	
Deciduous stands	% of natural	Funded 2012	2012-2	Indicator data summary	$12,612 (part)	1 year	Complete	

[4] Ordered by secondary score (all topics have high priority for data collection; see Monitoring Framework for methods www.babinctrust.ca).

Objective	Indicator	History	Project #	Project name	Funding	Project length	2014 Status	Rationale
Water quantity	ECA Kispiox	Funded 2012	2012-2	Indicator data summary	$12,612 (part)	1 year	Complete	
Connectivity	Winter logging	Funded 2010	2010-1	Industrial Activity Timing	$4,220	1 year	Initiated 2010	
Mountain goats	harvest during natal period	Funded 2010	2010-1	Industrial Activity Timing	as above	1 year	Complete	
Timber salvage	% salvaged	Funded 2012	2012-2	Indicator data summary	$12,612 (part)	1 year	Complete	
Backcountry recreation	Amount primitive	Funded 2010	2010-2	Recreation Opportunity Spectrum	$5,276	1 year	Complete	
Gunanoot Lake	Visual quality	Not funded	—	—	—	—	—	
Grizzly bears	harvesting in bear units	Funded 2009	2009-3	Grizzly Bear Habitat	$10,250	1 year	Complete	
Pine mushroom habitat	% mature sites	Funded 2011	2011-1	Non-timber Forest Products	$4220.40	1 year scoping	Complete	
Huckleberries	% sunlight in cutblocks	Funded 2011	2011-1	Non-timber Forest Products	$4220.40	1 year scoping	Complete	
Huckleberries	% soil disturbance	Funded 2011	2011-1	Non-timber Forest Products	$4220.40	1 year scoping	Complete	
Timber growth	% old stands	Funded 2012	2012-2	Indicator data summary	$12,612 (part)	1 year	Complete	
Access to recreation	Inaccessible destinations	Funded 2010	2010-2	Recreation Opportunity Spectrum	as above	1 year	Complete	

Table A 2. Improve Knowledge and Reduce Uncertainty (Validation Monitoring/Research).

Funding decisions for high-priority topics for monitoring to improve knowledge and reduce uncertainty. Topics are ordered by relative priority as determined by Monitoring Framework[6]. Shaded projects are completed, ongoing or planned for 2014.

Objective	Indicator	History	Project #	Project name	Funding	Project length	2014 Status	Rationale
Human/bear interaction	open road density Hanawald and Shedin	Indicator data funded 2007; assessment funded 2012; monitoring funding 2014	2012-1; 2014-1	Collaborative grizzly bear workshop; bear-human monitoring	$5,000; $10,000	1 year	Ongoing	
Tree species	% of natural	Funded 2012	2012-2	Indicator data summary	$12,612 (part)	1 year	Complete	
Core areas	% alteration	Funded 2011	2011-2	Ecosystem network and natural disturbance	Phase I: $2,110.20; Phase II: $21,102	1 year	Complete	
Connectivity	% of mature and old in corridors	Funded 2011	2011-2	Ecosystem network and natural disturbance	Phase I: $2,110.20; Phase II: $21,102	1 year	Complete	
Grizzly habitat	% high-value	Funded 2009	2009-3	Grizzly bear habitat	$10,250	1 year	Complete	
Goat habitat	% unmodified nearby (Gail Ck)	Indicator data funded 2008	—	—	—	—	—	
Goat habitat	Harvest during natal period	Funded 2010	2010-1	Industrial Activity Timing	$4,220.40	1 year	Complete	
Wilderness value of BRC	Auditory disturbance	Funded 2005; funded 2011; portion deferred	2005-4, 2006-3	Wilderness value of BRC	$5,000 in 2005; $15,000 deferred; $5,275.50 released 2011	2 – 3 years	Ongoing	
Wilderness value of BRC	Visual quality	Funded 2008; Collaboration with MoFR	2008-5	Visual quality of Babine River	$5,000 BWMT; MoFR $12,000	1 year	Ongoing	

[6] Ordered by priority to reduce uncertainty and then by secondary score (see Monitoring Framework for methods www.babinetrust.ca).

Table A 3. Detect Negative Consequences (Effectiveness Monitoring).

Funding decisions for high-priority topics for monitoring to detect negative consequences. Topics are ordered by relative priority as determined by Monitoring Framework[7]. Shaded projects are completed, ongoing or planned for 2014.

Objective	Indicator	History	Project #	Project name	Funding	Project length	2014 Status	Rationale
Sustainable use	Encounters in Natural Environment Zone	Funded 2005, 2007; deferred to 2011	2005-4 2006-3	Wilderness value of BRC	$5,000 in 2005; $15,000 deferred; $5,275.50 released 2011	2 years	Ongoing	
Stand structure	% retention; % various structures (Nichyeskwa)	Indicator data funded 2007; funded 2014	2014-2	Biodiversity effectiveness	$10,000 (part)	2 years	Initiated 2014	
Tree species	% of natural	Funded 2014	2014-2	Biodiversity effectiveness	$10,000 (part)	2 years	Initiated 2014	
Human/bear interaction	road density Hanawald, Shedin	Assessment funded in 2012	2012-1	Collaborative grizzly bear workshop	$5,275.50	1 year	Complete	
Timber salvage	% controlled	Not funded	—	—	—	—	—	Wait for completion of project 2012-2
Goat habitat	% unmodified nearby (Gail)	Indicator data funded 2008	—	—	—	—	—	
Goat habitat	Harvest during natal period	Funded 2010	2010-1	Industrial Activity Timing	$4,100	1 year	Ongoing	
Timber salvage	% susceptible	Investigation funded 2008	2008-1 (part)	Update Knowledge Base	$1,105	1 year	Needs further work	Wait for completion of project 2012-2
Connectivity	% mature and old in corridors	Not funded	—	—	—	—	—	Too expensive to monitor effectively within budget
Wilderness value of BRC	Auditory disturbance	Funded 2005, 2007; deferred to 2011	2005-4 2006-3	Wilderness value of BRC	$5,000 in 2005; $15,000 deferred; $5,275.50 released 2011	2 years	Ongoing	
Sustainable use	Floatcraft encounters	Funded 2005, 2007; deferred to 2011	2005-4 2006-3	Wilderness value of BRC	$5,000 in 2005; $15,000 deferred; $5,275.50 released 2011	2 years	Ongoing	
Wilderness	Visual quality	Funded 2008;	2008-5	Visual quality of	$5,000 BWMT;	1 year	Completed	

[7] Ordered by priority to detect consequences and then by secondary score (see Monitoring Framework for methods www.babinetrust.ca).

value of BRC	Collaboration with MoFR	Babine River	MoFR $12,000	2010

Appendix 2: Completed monitoring projects

Synopses of completed monitoring projects are included in the Annual Monitoring Plan until the results are incorporated into the Knowledge Base and included in other processes as appropriate (e.g. BWMT Plan Amendment Process and Criteria). Subsections listing consequences for the Knowledge Base, consequences for management and recommendations for monitoring summarise actions precipitated by each project.

Projects completed prior to 2010 have been incorporated into the Knowledge Base. Synopses of these projects are listed in the 5-year Activity Report that is available at www.babinetrust.ca.

Project 2013-5: Update BWMT Website

Abstract:

This project formed part of BWMT's communications strategy. The project revised the existing website to enable easier updating of information. The project aims to improve communication with all audiences.

Status: Initiated in 2013. Completed by March 2014.

Geographic scope: Babine Watershed.

Objectives listed in land-use plans: Not applicable.

Type of monitoring: All types

Project leaders: Taylor Bacharach

Potential Partners: None

Funding: $1,025 (including GST). Funds taken from project 2009-A4 (Funding Solicitation).

Consequence for knowledge base: This project will communicate the knowledge base and monitoring results.

Consequence for management: Increased knowledge of BWMT's work and monitoring results.

Project 2012-1: Collaborative grizzly bear workshop

Abstract:

This project provided seed funding for a collaboratively-run workshop for grizzly bear and ecosystem experts. A half-day discussion on the Babine was part of two days of workshops addressing grizzly bears. Discussion on day 1 focussed on building a risk model for grizzly bears applicable to the Northwest Cumulative Effects Assessment Pilot Area; discussion on day 2 was divided between determining monitoring priorities for the Babine Watershed and determining regional priorities for monitoring and management activities.

The Babine session was funded by the Babine Watershed Monitoring Trust in partnership with the Ministry of Forests, Lands and Natural Resources Operations.

The Babine portion of the workshop had three objectives: to assess previous work on Babine grizzly bears, including limitations of data and knowledge gaps; to direct future monitoring activities; and to bring together experts with an interest in Babine grizzly bears. Participants discussed the first two priorities together. An additional objective was to define the population of bears appropriate for analysis.

Workshop participants agreed that risk near the bridge and weir is extreme and unsustainable. They provided priorities for monitoring and management as follows (in order):

1. Reducing uncertainty about unreported mortality near the park entrance and plugging the potential populations sink.
2. Reducing uncertainty about the grizzly bear population and the significance of mortality on the whole population
3. Improving habitat classification.

They suggested potential monitoring methodologies including collaring, collecting hair for DNA analysis and monitoring human behaviour and patterns of use.

Status: Completed March 31, 2013.

Geographic scope: Population of grizzly bears that use the Babine Watershed.

Objectives listed in land-use plans: Various under goals to maintain grizzly bears in all plans.

Type of monitoring: This project will assist with prioritising future monitoring.

Contractor: Dave Daust

Partners: MFLNRO and MoE through NorthWest Cumulative Effects Assessment Pilot Project.

Funding: $5,000 (before HST)

Consequence for knowledge base: This project provided a peer-review of BWMT grizzly bear work to date and assisted with prioritising future monitoring. Information summarised from the workshop will allow updates of the knowledge base.

Consequence for management: This project will support management decisions, through appropriate processes which are separate from the BWMT, by showing the level of risk and uncertainty associated with strategies to maintain grizzly bears. It may increase confidence in current activities, suggest further monitoring projects or lead to initiation of a plan-amendment process.

Project 2012-2: Indicator data summary

Abstract:

This project collected and summarised missing or updated indicator data for several objectives. Stand structure, deciduous stands and tree species are indicators related to the objective of maintaining biodiversity; timber salvage is an indicator for maintaining timber supply; equivalent clearcut area (ECA) is an indicator for maintaining water quality. The analysis was based on vegetation resources inventory (VRI), and harvesting, wildlife tree patch and road data assembled from the Ministry of Forests, Lands and Natural Resource Operations, Pacific Inland Resources, and Timber Sales BC.

Stand Structure: In the Bulkley Timber Supply Area (TSA) 13.6% of cutblock area was reserved; 7.7% was reserved in the Kispiox. The amount reserved varied by subzone, generally with greater percent in reserves in the higher elevation ESSFmc subzone than in the lower elevation SBSmc2 and ICHmc subzones. The area in wildlife tree patches was generally well above that required in the land-use plans. However, there is evidence that retention levels higher than those in land-use plans is required to be effective in maintaining biodiversity. Wildlife tree patches had a lower site index than harvested areas, indicating that reserve areas are generally less productive and not representative of the pre-harvest stand condition. There are two potential issues: 1) reserve areas may not have the same biodiversity functions as the harvested areas, the biodiversity of which they are supposed to maintaining, and 2) reserve area could be comprised of areas that would not have been harvested due to low productivity, hence are not truly "reserves". Additional information on reserves and a more detailed analysis of the composition of reserve areas compared to harvested areas could clarify these potential issues.

Tree Species: Many tree species were below natural levels in several landscape units. Deciduous tree species were under-represented in young stands in the ICHmc and SBSmc2. In the SBSmc2, deciduous trees were also under-represented in mature stands. On closer examination much of the pole seral stage in the SBSmc2 resulted from fires, with fires lacking in the time period that would have produced young deciduous stands. Analysis of tree species at the subzone within landscape unit level subdivides the study area into regions that may be too small for meaningful analysis of landscape level patterns, and may reflect variation in disturbance rather than harvesting practices. Over a larger area the effects of single disturbance events would have less influence on the results. The under-representation of deciduous tree species needs further investigation to determine causation. A more detailed analysis of the composition of stands pre and post-harvest is warranted, if cruise or harvest data are available. This analysis would look at deciduous and coniferous tree species to determine if deciduous species are being retained and if coniferous species diversity is being maintained.

Timber Salvage: Since 2005 Pacific Inland Resources has harvested 2,604 ha in the Babine Watershed, all in the Bulkley TSA. This amounts to 4.3% of MPB total attacked area in the Bulkley TSA, but a somewhat larger portion of the area attacked since 2005. All of the recent harvest in the Bulkley TSA has been salvage of MPB attacked stands. The amount of salvage is quite low in proportion to the area mapped as being attacked by MPB. This is partly due to PIR harvesting MPB attacked stands in other areas where the MPB outbreak started earlier and was more severe than in the Babine.

ECA: The Cataline watershed was over the trigger level of 20% by 15%, when the ECA was calculated in 2004, and the Gail watershed was approaching the ECA limit. With the low level of harvesting in the Cataline and Gail watersheds since the ECA was completed and the hydrological recovery through tree growth the ECA has likely decreased. None of the watersheds in the Bulkley TSA are over the ECA triggers or limits, even with the current level of MPB killed trees added as equivalent to clearcut. An analysis of ECA done for the Bulkley TSA

in 2011, found that none of the identified sensitive watersheds in the Bulkley portion of the Babine Watershed exceed ECA targets.

Status: Completed March 10, 2014

Geographic scope: Babine Watershed unless specified (i.e. ECA for Kispiox portion).

Objectives listed in land-use plans: Various, including deciduous stands, tree species and stand structure under the goal to maintain biodiversity, water quality, and timber salvage and growth.

Type of monitoring: Collecting indicator data (implementation monitoring).

Contractor: Adrian de Groot, Drosera Ecological Consulting, and Johanna Pfalz, Eclipse GIS

Funding: $12,000 (before HST)

Consequence for knowledge base: This project collected indicator data to facilitate risk analysis and provide priorities for future monitoring.

- **ECA**: uncertainty was low, hence no further inventory is necessary;
- **Deciduous (and other) Tree Species:** the analyses were inconclusive, hence further inventory is required,
- **Stand Structure**: uncertainly was low and the risk was high;
- **Timber Salvage**: salvage was only occurring for mountain pine beetle attacked stands and risk was high as only a small portion of MPB attacked stands were being harvested.

Consequence for management: This project found that further inventory is necessary to allow for better determination of the maintenance of tree species diversity. It found that the area in wildlife tree patches was too low to reduce risk to biodiversity and that the amount of salvage harvesting for mountain pine beetle was too low to reduce risk to timber supply. It confirmed that management is meeting ECA targets. This knowledge will support management decisions, through appropriate processes which are separate from the BWMT.

Project 2011-1: Non-timber Forest Resources

Abstract:

This project summarised the current indicator data for pine mushroom and huckleberry habitat in the Babine watershed based on existing mapping of mushroom areas, predictive ecosystem mapping (PEM), vegetation resources inventory (VRI), vegetation plots and information from First Nations on berry gathering areas.

At least three quarters of mapped mushroom sites are greater than 80 years of age, which is well above the 60% objective described in the SRMP. No logging has occurred within the pine mushroom habitat areas since the SRMP was implemented in 2004. The areas are relatively remote and the wood is of low value, hence threat is low. Impacts of mountain pine beetle are expected to be low. Risk to pine mushroom habitat overall is currently low.

The study developed a rough model for black huckleberry habitat potential using PEM, VRI and huckleberry prominence data for the berry management areas and the Babine watershed as a whole. Adding elevation, slope and aspect could improve the model. Berry habitat occurs within a matrix of other habitat types within the mapped berry management areas. These berry management areas have not been disturbed within the past 80 years, so that opening that were previously maintained by fire by Gitxsan people have become overgrown with vegetation that competes with black huckleberry for light and results in declining berry productivity. Only 18% of the mapped berry management areas appear to have sufficient sunlight for optimal berry production, and only a portion of these will actually produce good crops because of many other influential factors.

Pine mushrooms and huckleberries are both important cultural resources. If further work is appropriate, this project will design a process to involve people with an interest in the resources.

Status: Initiated in 2011. Completed 2012.

Geographic scope: Kispiox portion of Babine watershed.

Objectives listed in land-use plans: The Kispiox SRMP includes an objective to maintain high-value pine mushroom sites and to maintain or enhance the productivity of berry habitat within berry management areas.

Type of monitoring: Collecting implementation monitoring data

Contractor: Larry McCulloch

Funding: $4,000 (before HST)

Consequence for knowledge base: This project collected indicator data on pine mushroom and huckleberry habitat. Risk to pine mushroom habitat is currently low, but the capacity of black huckleberry habitat is declining due to vegetative competition and lack of disturbance.

Consequence for management: This project will support management decisions, through appropriate processes which are separate from the BWMT, by showing the level of risk and uncertainty associated with strategies to maintain pine mushroom and berry habitat. Current strategies for maintaining pine mushroom habitat are adequate. Improving the state of berry habitat requires collaboration and prescribed burning.

Project 2011-2: Ecosystem Network and Natural Disturbance

Abstract:

This study evaluated the impacts of mountain pine beetle and associated logging in the ecosystem network against indicators of biodiversity including the extent and size of logged areas, changes in the proportion of mature and old forest, road levels, connectivity/interior forest condition, and disturbance of sensitive ecosystems. In general, risk for these indicators is low on the Kispiox side of the watershed because there is less pine there, and less harvesting and road construction has occurred in recent years. There is also relatively low risk in core ecosystems throughout the watershed because pine is the leading species on only about 5% of the area in the core. Within Landscape Riparian Corridors (LRC), pine is the leading species on 4% to 14% of the area (Kispiox and Bulkley respectively) and susceptible pine stands (>10% pine greater than 40 years old) occupy about 16% of the ecosystem network. It is a significant component of many stands in localized areas, however, particularly in the SBSmc2 on the Bulkley side of the watershed, where it is the leading species on about 27% of the LRC and in the special management zone surrounding Babine River Corridor park where 13% of the zone is more than two thirds pine.

Mountain pine beetles, in the absence of logging, create conditions that are less like *forest interior* with fewer mature trees and less overstory cover. They also lead to more structure in terms of snag levels, coarse woody debris, and understory vegetation. Impacts become more significant when beetle-affected areas are logged. Stand structure in clearcut areas is usually substantially different than that in unlogged beetle affected areas.

To date, 206 ha (<1% of core ecosystems) and 1280 ha (~3% of LRC ecosystems) have been logged. There are 37 openings bigger than 10 ha within the ecosystem network. If all stands that are currently greater than 60 years old with more than 33% pine are attacked by pine beetle, an additional 1910 ha in core ecosystems and 4086 ha in LRC ecosystems will be affected. Even with aggressive assumptions on pine beetle impacts like these, 86% of core ecosystems and 77% of the LRC will be mature or old forest. The risk to biodiversity in the SBSmc2 portion of the ecosystem network, however, would be substantially greater, with only 67% of the Core and 63% of LRC in mature or old forest. Within the SBSmc2, if all susceptible pine stands are attacked and subsequently logged, the target threshold for 70% of structure and function would not be met. If they were attacked but were not logged, field data indicate that considerable structure will be retained but the number of large live trees and future snag and coarse woody debris recruitment might be compromised.

The potential impact of roads may be more significant than beetle attack or cutblocks. Land use plan objectives respecting roads are to avoid any in core ecosystems and to ensure that access into the landscape riparian corridors is temporary unless no other alternative is reasonable, yet there is considerable road development within the ecosystem network totalling ~140 km. There are 14 km of road through mature or old forest within Core ecosystems and an additional 50 km through mature or old forest within LRC ecosystems

While there are no measurable criteria in the land use plans describing acceptable level of road development in the ecosystem network, the level of road development to date seems inconsistent with the intent in the original land use plans. Densities of 0.41 km/km^2 in the Bulkley LRC approach a level that raises a red flag. There is uncertainty about road status.

Cutblocks also influence habitat fragmentation. Habitat connectivity and the maintenance of interior forest condition is an objective in all the land use plans. There are 28 places where cutblocks within the LRC have created a condition where the landscape corridor itself is less than 500 m wide, potentially resulting in little or no interior forest condition totalling 31 km of corridor. This metric indicates that there are areas in which the corridor itself is unlikely to provide the attributes necessary for full ecosystem function and the maintenance of biodiversity as it is defined in the land use plans. Currently, mature or old forest exists outside

the corridor adjacent to many of these sections thus reducing the degree to which ecosystem function is potentially impaired.

Risk to rare or sensitive ecosystems is low. These ecosystems generally have low levels of pine and/or low commercial timber value.

In summary, threshold levels for biodiversity indicators in the ecosystem network of the Babine Watershed, as they are defined in the land use plans, have been exceeded as a result of the cumulative impacts of mountain pine beetle and timber harvesting that may be associated with it, in a number of ways:

- limited logging has occurred in core ecosystems.
- limited road construction has occurred in core ecosystems.
- substantial road development, some of which appears to be permanent, has occurred in the LRC.
- just under 70% of mature structure and function has been maintained in the SBSmc2 portion of the LRC, with this potentially dropping to 63% with future beetle impacts.
- limited areas greater than 3.0 ha in size have been logged in the LRC.
- sections of the ecosystem network are not wide enough (< 500m) to maintain interior forest condition.

The majority of these deficiencies will have relatively low impact on ecosystem function because they are limited in extent. Disturbance in the SBSmc2, however, is approaching or exceeding threshold levels on a larger scale. Future planning should provide a hedge against uncertainty by finding ways to avoid new permanent road construction in the network and to avoid clearcut harvesting in sections of the network which are close to the 70% threshold for mature structure and function. This is especially important where opportunities to replace the existing network with other areas with the same functional attributes are limited.

Status: Initiated in 2011. Completed 2012.

Geographic scope: Babine Watershed.

Objectives listed in land-use plans: Land-use plans include objectives to maintain core ecosystems and to maintain the function of landscape corridors. Ecosystem networks (core areas and landscape riparian corridors) are essentially a strategy for achieving other objectives. Objectives for landscape corridors include maintaining the connectivity of mature and old forest (Kispiox SRMP Table 2) and retaining most of the structure and function associated with old forest (Bulkley Landscape Unit Plans).

Type of monitoring: Reducing uncertainty and collecting baseline data

Contractor: Larry McCulloch

Potential partners: Glen Buhr, MoFR; Dave Ripmeester, PIR (Collaborative HLP Objective Spatial Analysis Project)

Funding: Phase I: $2,000 (before HST); Phase II: $20,000 (before HST)

Consequence for knowledge base: This project determined that current risk to biodiversity and ecological function in core ecosystems and most LRCs due to pine beetles and logging is low, except in SBSmc2 ecosystems. Risk due to roads is higher, approaching high in some areas.

Consequence for management: This project will enable better management decisions to be made, through appropriate processes which are separate from the BWMT, by reducing the level of uncertainty associated with the status of the ecosystem network. It increases confidence in current strategies for logging, but suggests further consideration is necessary in relation to roads. It also suggests that flexibility in corridors would be useful to adjust for harvesting and maintain a minimum width of 600m.

Project 2009-1: Rare Ecosystems Phase I and II

Abstract:

This project identified and mapped known occurrences of rare ecosystems in the Babine Watershed from one rare ecosystem survey, the Ministry of Forests BEC plot database, five terrestrial ecosystem mapping (TEM) projects, one predictive ecosystem mapping (PEM) model accuracy study, and two PEM projects. It compared data sources in terms of reliability and quality, and made recommendations about how to address knowledge gaps. About 70% of the watershed has been mapped using TEM, and the entire watershed has been mapped by PEM. However, only 2% of the area has been studied with appropriate survey intensity.

The reliability and quality of the data varies among mapping projects. For some projects there is certainty in the reported occurrences of rare ecosystems, while for other projects it is only possible to suggest sites that may support rare ecosystems. Existing TEM projects have been primarily designed to address wildlife concerns and the resulting data are insufficient for evaluating rare ecosystems. TEM mapping with high sampling intensity can help guide ground-truthed verifications of potential rare ecosystems. PEM is inadequate to provide reliable information about occurrences of rare ecosystems in the Babine watershed due to accuracy and resolution issues with the models. PEM may be useful for highlighting areas with the potential for supporting rare ecosystems.

Reliable reports have identified 25 occurrences of eight blue-listed ecosystems and 21 occurrences of seven regionally-rare ecosystems in the Babine watershed (Tables 1 and 2). This list excludes interpreted and predicted ecosystems. The small number of rare ecosystems reported likely reflects a low effort to document rare ecosystems in the area.

Table 1. Confirmed occurrences of rare ecosystems in the Babine watershed.

Ecosystem	Biogeoclimatic unit	Occurrences
Western hemlock – lodgepole pine – kinnikinnick – Cladonia lichens	ICHmc1/02 ICHmc2/02	3
Hybrid white spruce – paper birch – devil's club	ICHmc2/54	5
Black cottonwood – red osier dogwood floodplain	ICHmc1/Fm02 or ICHmc1/05 or ICHmc2/Fm02 or ICHmc2/06	5
Black cottonwood – hybrid spruce – red osier dogwood	SBSmc2/Fm02	4
Drummond's willow – blue-joint reedgrass	SBSmc2/Fl05	1
Scrub birch – water sedge	SBSmc2/Wf02	2
Shore sedge – buck bean – hook moss fen	SBSmc2/Wf08	2
Lodgepole pine – few flowered sedge - Sphagnum	SBSmc2/Wb10	3

Table 2. Confirmed occurrences of regionally-rare ecosystems in the Babine watershed.

Ecosystem	Biogeoclimatic unit	Occurrences
Subalpine fir – lodgepole pine – juniper – Cladonia lichens	ESSFmc/02 ESSFmcp/02 ESSFmcw/02	5
Subalpine fir – lodgepole pine –	ESSF wv/02	1

Cladonia lichens		
Black spruce – lodgepole pine - feathermoss	SBSmc2/03	3
Trembling aspen – paper birch-hazelnut – red osier (birch dominated of frequent fires)	ICHmc2/52 ICHmc2/53	8
Western redcedar- hybrid spruce – horsetail – skunk cabbage	ICHmc2/07	1
Fluvial Ranunculus meadows	SBSmc2/ESSFmc	2
Mesic cow parsnip meadows	ICHmc2	1*

*This ecosystem has anthropogenic causes.

The study found several knowledge gaps. Overall, ecologists know very little about the status of non-forested ecosystems and rare phases of more common forested ecosystems in the Babine watershed. These unclassified ecosystems may be very rare, declining and experiencing threats, but there is no information available to assess them. Currently, a system for classifying non-forested ecosystems is being developed for BC, though only broad site classes have been described to date. It will take time to classify all non-forested ecosystems in sufficient detail to assess conservation status.

Additional surveys will be needed to meet the management objective of maintaining rare ecosystems because existing data on the types, numbers, locations and extents of rare ecosystems of the Babine watershed are insufficient and greatly under-represent the area's true diversity. A priority approach to field surveys could be developed to help direct plans for field surveys with a modest budget. High priority areas for further inventory include alpine and subalpine ecosystems, upland shrub ecosystems, and avalanche tracks. These ecosystems are key features of the Babine watershed and have received very little attention to date. Additionally, there needs to be a mechanism in place to highlight rare versions of common site series, even of very common forested ecosystems (e.g. antique forests).

With the information summarized from all available sources, there are insufficient data to determine whether objectives to maintain rare ecosystems are being met. However, it is possible to assess implementation of the reliably-identified rare ecosystems. There are 22 listed or regionally rare ecosystems in the Bulkley TSA portion of the watershed. Six of these occurrences occur in areas of conservation, representing 27% of the known occurrences. This level of conservation potentially poses high risk to rare ecosystems.

Status: Phase I initiated in 2009. Phase II initiated in 2010 and combined for efficiency. Completed 2012.

Geographic scope: Babine watershed.

Objectives listed in land-use plans: The Kispiox SRMP and Bulkley LUPs include objectives for maintaining rare ecosystems.

Type of monitoring: Collecting implementation data

Contractors: Patrick Williston and Paula Bartemucci, Gentian Botanical Research

Potential partners: Allen Banner, Sybille Haeussler, MoFR

Funding: $3,000 in 2009; $7,000 in 2010; Total: $10,000 (before HST).

Consequence for knowledge base: This project collected indicator data on rare ecosystems to facilitate risk analysis and provided priorities for future monitoring. The project found that uncertainty remains high and that further inventory is necessary.

Consequence for management: This project found that further inventory is necessary to allow full monitoring of rare ecosystems. For the sub-set of reliably identified ecosystems within the Bulkley TSA, risk is potentially high. These results will be passed on to other organisations, through appropriate processes which are separate from the BWMT.

Project 2009-2: Human/grizzly Bear Interactions and Education: Baseline Data

Abstract:

This project summarised and analysed spatial information on grizzly bear mortality in the Babine watershed based on compulsory inspections and problem wildlife occurrence databases and previous reports. It also summarised the status of current bear awareness education based on a survey of available information and interviews.

Since 1990, 59 grizzly bears are known to have been killed through the legal hunt (47), illegal hunt (6) and as problem wildlife (6). Mortality was evenly split between males and females. There is no estimate of the number of bears killed by the legal First Nations harvest or following human/bear conflicts on First Nations lands. The spatial distribution of mortality is related to guide outfitter territories, human settlements and road access.

Human/bear conflict resulting in a problem wildlife occurrence report was most common around Fort Babine and the DFO fish fence due to the availability of domestic anthropogenic attractants and the availability of fish pooled at the weir.

The data suggest a high mortality rate within Wildlife Management Unit 6-8, although these analyses are highly uncertain without better knowledge of the population within the entire grizzly bear population unit. There is potential for source-sink dynamics, with the weir drawing bears from a larger area, but study of the population at a broader scale is necessary to decrease uncertainty.

Access to educational messages was limited in the Babine watershed and varied by organisation. BC Parks staff received rigorous training, but it was unclear whether this information was passed on to park users because no permanent ranger worked in the park.

As well as collecting indicator data that will be useful in the short term, the study will provide a baseline for future studies examining the effectiveness of management activities.

Status: Approved in principle in 2009. Modified in 2011. Completed in 2012.

Geographic scope: BWMT area plus area beyond to include home range of adult female grizzly bears using the BWMT area.

Objectives listed in land-use plans: The entire plan area has objectives to minimise bear/human conflict. The Kispiox SRMP has a strategy for increased public bear awareness, and the Babine River Corridor MDS has a strategy to develop bear awareness and safety information and guidelines.

Type of monitoring: Collecting baseline data for effectiveness monitoring

Contractor: Lana Ciarniello, Aklak Wildlife Consulting

Funding: $10,000 (before HST)

Consequence for knowledge base: *This project collected baseline data to examine the potential effectiveness of education on reducing human/grizzly bear interactions. The study confirms that mortality is associated with roads and settlements.*

Consequence for management: *This project will enable better management decisions to be made, through appropriate processes which are separate from the BWMT, by suggesting data-collection details required for better analyses of the effectiveness of management activities. In particular, it focuses on the necessity of monitoring the entire grizzly bear population unit to determine mortality. It also suggests the need for consistent bear education messages.*

Project 2010-2: Recreation Opportunity Spectrum

Abstract:

This project collected indicator data on recreation opportunities in the Babine watershed. Recreation Opportunity Spectrum (ROS) mapping is a method of looking at the landscape to determine what types of recreational experiences are being provided over a landbase in terms of remoteness, naturalness and expected social experience. Recreation opportunity categories in the Babine Watershed included *Primitive*, *Semi-primitive Non-motorized*, *Semi-primitive Motorized*, *Roaded Natural* and *Roaded Modified*. A map of the road network in the area, interviews with people familiar with recreation in the area and past ROS mapping were used in the mapping process.

Recreational features in the Babine watershed include alpine areas, lakes and waterways, with some facilities and trails present to service these features. Recreational activities in the watershed include: angling, hiking, hunting, camping, snowmobiling, all terrain vehicle travel, skiing, rafting, kayaking, jet-boating, botanical forest product harvesting, and wildlife viewing. Some of these activities, such as angling, are concentrated mostly on one feature – the Babine River, while others, such as snowmobiling are dispersed over much of the watershed.

Five ROS Classes were mapped in the Babine Watershed. Areas that are essentially non-motorized cover 61% of the watershed, being in the *Primitive* or *Semi-primitive Non-motorised* classes (Table 1). The *Roaded Modified* class covers the second largest area in the watershed, covering all areas where forest harvesting has occurred. *Semi-primitive Motorized* areas are few due to the difficulty of traveling in non-roaded areas with motorized vehicles, and the relatively low levels of motorized use in this remote area.

Table 1. Portion of Babine Watershed in each Recreation Opportunity Spectrum class.

ROS class	Area (ha)	% of total area
Primitive	107,535	26.8
Semi-primitive non-motorized	128,878	32.1
Semi-primitive motorized	38,984	9.7
Roaded natural	6,818	1.7
Roaded modified	119,718	29.8

Lakes in the watershed occurred in most ROS classes, with eleven lakes being in the Primitive class, nine in the Roaded modified class, four in the Semi-primitive non-motorized class and one in the Semi-primitive motorized class. Most of the Babine River is in the Semi-primitive motorized class, due to use by jet-boats.

Most alpine areas are in the Semi-primitive non-motorized class due to the proximity of roads, though significant portions of the alpine in the north are in the Primitive class. Some alpine areas in the Primitive and Semi-primitive non-motorized classes will have some motorized use, especially from snowmobiles, but their remoteness means motorized usage will be light enough to justify these non-motorized classes.

The land management plans covering the Babine Watershed give direction to implement several access control points to protect wilderness values and tourism, and grizzly bears. Some of these access control points have not been implemented or are ineffective in controlling access as intended. The lack of plan implementation or ineffectiveness of measures in the plan should be rectified so that recreational values are not compromised.

Status: *Completed March 31, 2011.*

Geographic scope: *Babine watershed.*

Objectives listed in land-use plans: The Kispiox LRMP includes an objective to maintain primitive recreation opportunities. The SRMP and Nilkitkwa LUP specify areas intended to provide backcountry recreation opportunities. The Babine LUP and Kispiox LRM include an objective to maintain access to recreation destinations.

Type of monitoring: Collecting implementation data

Contractors: Adrian deGroot and Johanna Pfalz

Funding: $5,000 (before HST)

Consequence for knowledge base: This project determined that risk to recreation opportunities is currently low with some uncertainty in relation to lack of implementation or success of access control.

Consequence for management: This project found that primitive and semi-primitive recreation opportunities are well represented. Access to features has not been affected by industrial activity. One potential management issue is that the lack of plan implementation or ineffectiveness of measures may compromise recreational values. In particular, access control points at Sperry/Rosenthal 1, Shenismike West 2, Thomlinson Road 6 have not been implemented, the access control points at Nichyeskwa Connector 7 has been breached and Nilkitkwa 481 Road may have been breached.

Project 2009-3: Grizzly Bear Habitat

Abstract:

This project will reduce uncertainty about maintenance of grizzly bear habitat due to the variety of different strategies applied in different management areas. The project will develop a database about grizzly bear habitat that is relevant to resource managers in Babine Watershed, analogous to the database for mountain goats created in 2008/9. The database will include grizzly bear management areas, high-value habitat, critical habitat, other habitat classes, harvested areas, forest cover, strategies implemented within and adjacent to habitat. This database will build on the access database created during project 2007-1 (Human/ Bear Interaction and Open Road Density) this year.

The project will also initiate development of effectiveness indicators looking at grizzly bear use of habitat. The variety of strategies implemented presents an excellent opportunity for an experiment: this project will consider potential designs for such a project (funding is beyond the scope of the BWMT).

Status: Initiated in 2009. Completed March 31, 2010. Awaiting final report and summary.

Geographic scope: Babine watershed.

Objectives listed in land-use plans: All land-use documents include objectives to maintain grizzly bear habitat.

Type of monitoring: Collecting implementation data

Contractors: Johanna Pfalz, Debbie Wellwood.

Partners: Bear biologists through the cumulative effects modelling process led by Debbie Wellwood and funded through other means.

Funding: $10,000 (before taxes)

Consequence for knowledge base: This project collected indicator data on grizzly bear habitat to facilitate risk analysis.

Consequence for management: This project will enable better management decisions to be made, through appropriate processes which are separate from the BWMT, by showing the level of risk and uncertainty associated with current protection of grizzly bear habitat. It may increase confidence in current activities, suggest further monitoring projects or lead to initiation of a plan-amendment process.

Project 2008-5: Visual Quality in Babine River Corridor

Abstract:

This project investigated visual quality in the Babine River Corridor in collaboration with Glen Buhr, Ministry of Forests and Range. The project had three objectives: to compile existing mapping and photo information for established viewpoints along the Babine River Corridor, to update photo panoramas and to compare the effectiveness of quantitative (FREP protocol) and qualitative (stakeholder surveys) methods at determining whether Visual Quality Objectives have been achieved.

Panoramic photographs have been assembled from existing negatives and from new images for all 18 established viewpoints within the Babine Corridor. Because of the incised nature of the Babine River channel, only one viewpoint, Viewpoint 3, on the lower Babine River, has harvesting visible from the river. Viewpoint 3 has a Visual Quality Objective of "Partial Retention". The quantitative protocol measured an alteration of 12.7%, equating to a classification of "Moderate" (7.1 – 18% alteration). Field assessment, however, assigned a classification of "Partial Retention". Because the two methods disagree, the formal protocol defines the Effectiveness Evaluation for this Viewpoint as "Borderline".

Overall, risk to viewscapes in the upper and lower reaches of the Babine River is low due to the limitation of viewscapes to areas within the park. Risk in the middle reaches is greater as the river valley is wider and more open. To date, no harvesting is visible in the middle reaches. The Atna-Shelagyote Special Management Zone will provide protection to viewscapes in the middle reaches of the river on the north bank, but future harvesting may impact viewscapes elsewhere.

The public survey portion of the project was limited in success as only five people filled out forms despite wide advertising. Only one respondent provided comments about any viewscapes within the Babine River Corridor (though several commented about viewscapes along Nilkitkwa and Babine Lake (outside the BWMT area of interest). It is possible to conclude, however, that people do not have pressing concerns about visual quality at the current time.

Status: Initiated in 2008. Collaboration with MoFR. Completed 2011.

Geographic scope: Babine River Corridor.

Objectives listed in land-use plans: Both the Kispiox and Bulkley LRMPs include objectives for visual quality as well as objectives to maintain the visual elements of wilderness value along the Babine River Corridor.

Type of monitoring: Reducing uncertainty and detecting negative consequences.

Contractors: Ralph Kossman, Megan D'Arcy

Partner: Glen Buhr, Ministry of Forests and Range provided $12,000.

Funding: $5,000 (before taxes)

Consequence for knowledge base: This project has determined that there are currently no negative consequences in relation to visual quality as an element of wilderness value in Babine River Corridor. Unfortunately, due to the lack of Viewpoints with visible harvest, it was not able to reduce uncertainty about discrepancies between quantitative measures of visual quality and public perception.

Consequence for management: This project demonstrates that strategies are currently adequate to ensuring visual quality in the Babine River Corridor. There is no need to revisit visual quality objectives until harvesting increases in the middle reaches of the Babine River.

Combined Project 2008-1 and 2008-2: Update Knowledge Base and Monitoring Priority Tables and Framework Manual and Extension

Abstract:

The first part of this project updated the Knowledge Base by including information gathered from all completed BWMT projects to 2010, investigating and incorporating existing information on landslides, and timber salvage, and consulting experts as necessary for new research and missing model variables. It also re-analysed risk and revised project priority tables for use during the 5-year monitoring period from 2010 – 2015.

The companion part of this project aimed to increase the number of people able to use the monitoring framework. It resulted in a short promotional description of the framework for use in fundraising, and a plain-language manual to complement the framework. In addition, a trainee worked on the update to learn about the framework.

The update was intended to include new objectives and strategies from a Park Management Plan that was being developed for the Babine River Corridor. However, the Park Management Plan process stalled, and due to new priorities, it will not be completed in the foreseeable future.

Status: Initiated in 2008 (first update since 2004). Completed by March 31, 2010.

Geographic scope: Babine watershed

Objectives listed in land-use plans: All objectives and strategies.

Type of monitoring: All types of monitoring.

Project team: Karen Price, Dave Daust, Liz Osborn, Megan D'Arcy, Jeff Anderson

Funding: $12,000 (2008-1) + $5,000 (2008-2) for a total of $17,000 (before taxes) budgeted; $2,306.25 returned to operating fund due to lack of new objectives from park plan.

Consequence for knowledge base: This project updated the knowledge base and priority tables. It will facilitate monitoring decisions for 2010-2015 and beyond. A plain-language manual will assist communication with potential funding sources.

Consequence for management: This project fed back information into the Knowledge Base and highlighted information to be passed on to bodies responsible for management decisions through appropriate processes.

Appendix 3: Objectives and Indicators Lacking Targets

This assessment, updated October 5, 2011, is based on the Babine Watershed Monitoring Trust's Knowledge Base and Priority Tables which were updated in early 2010. These tables consider all objectives and strategies listed in the land-use plans that apply to the Babine Watershed.

Objective	*Indicator*	*Notes*	*Land-use Plans*
Maintain biodiversity			
Maintain natural seral-stage distribution of ecosystems	% old forest by BEC variant	The indicator allows for high uncertainty (BHLP says "*maintain biodiversity by maintaining a natural seral-stage distribution*", but Table 1 targets will likely not lead to a "*natural seral-stage distribution*". Targets need to be defined by productivity class within BEC variant to reduce uncertainty in future estimates (see BWMT project 2007-4P).	BHLP Table 1 SRMP Table 2;
Maintain connectivity in landscape corridors	% mature and old forest within corridors	No specific target in the Bulkley ("*most of the structure and function associated with old forest...*" BHLP); though LRMP lists target of 70% existing structure and function. (70% in Kispiox)	BHLP 1.3a LRMP 2.3.1.2 SRMP Table 2
Maintain connectivity in landscape corridors	% winter harvest in corridors	No target in Bulkley (100% in Kispiox)	Not in BHLP (or LUPs or LRMP) SRMP Table 2
Maintain deciduous ecosystems	% of natural deciduous-leading ecosystems	No targets ("*diversity of...deciduous species representing the natural species composition for each ...subzone*" BHLP); LUPs ("*retain a portion of these species...*"); no target in Kispiox	BHLP 1.4a LUP 1.6.4 SRMP 3.1.1.2
Maintain sensitive riparian areas	% alteration to fluvial ecosystems	Bulkley has no target for alteration beyond FRPA. FRPA targets for riparian reserve and management zones do not reflect the extent of fluvial ecosystems. (No alteration in Kispiox).	Not in BHLP SRMP Table 2
Attain natural landscape pattern	% of area in each patch-size class (logged in Kispiox; nearing rotation age in Bulkley)	Current targets are unrelated to objective (see BWMT project 2007-4P). Targets should be expressed as patch size distribution of mature and old forest rather than distribution of harvested or young forest. Total amount of mature or old forest is the best indictor; patch size distribution has limited predictive power (see project 2007-4P).	Not in BHLP LUPs 1.5 Table 5 SRMP Table 2
Maintain stand structure	Wildlife tree patches and	Current targets are not related to natural amounts (see project 2005-5P	BHLP Table 2 SRMP Table 5

	attributes	for natural amounts in the Babine) and are below levels that provide benefits to biodiversity. Concept in LRMP (closer to natural is more likely to maintain biodiversity) is lost in LUPs (and BHLP). "*Maintain the range of structural attributes of old forests...*" SRMP Table 2 is not consistent with Table 5.	
Maintain grizzly bears			
Reduce human/bear interaction	Open road density	This is the best indicator of human/bear interaction. No targets beyond Hanawald and Shedin (Kispiox). BWMT project 2007-1 shows that some sub-basins are already approaching high-risk threshold. BHLP does not provide target and provides no direction for roads in high-value habitat: ("*limit road development...within moderate-value grizzly bear habitat*"; "*avoid human-bear conflicts in high-value grizzly bear habitat*")	BHLP 2.5c (for moderate-value habitat); 2.5d SRMP
Reduce human/bear interaction	Initiation of education programmes	No targets (objective only exists in Kispiox)	Not in BHLP SRMP
Reduce human/bear interaction	% of road with screening	No targets in BHLP; in Babine SMZ in BLUP; No target in Kispiox	Not in BHLP BLUP 4.1
Maintain mountain goats			
Maintain goat populations	Road density < 1km of identified habitat	No target for Kispiox (not in BHLP)	Not in BHLP No direction in SRMP—notes that LRMP direction could result in future guidelines (3.1.2.3)
	% harvest during natal period < 200m from habitat	No target for Kispiox (BHLP "*provide security...by limiting disturbance*")	BHLP 2.3b very vague. No direction in SRMP—notes that LRMP direction could result in future guidelines (3.1.2.3)
Maintain fish habitat and populations			
Maintain bull trout	% habitat protected	No target in Bulkley. See BWMT project 2008-4 for assessment of critical and important habitat. SRMP has single target of no permanent	Not in BHLP SRMP Table 8

		bridge near staging areas.	
Maintain steelhead	Repeated capture	No target for park	Park MDS
Water			
Maintain water flow	ECA %	No targets in Bulkley (changing provincial regulations mean that not all watersheds are subject to assessment); (SRMP has triggers for overview)	Not in BHLP SRMP Table 10
Maintain water quality	Landslides resulting from management	No target for Bulkley (SRMP target = 0)	Not in BHLP SRMP Table 9
Maintain water quality	Sediment from road crossings	No targets for Bulkley (SRMP target = low risk at specified crossings)	Not in BHLP SRMP Table 9
Maintain water quality	Planning	No targets for Bulkley (SRMP target = development of listed plans)	Not in BHLP SRMP Table 9
Timber			
Promote rapid timber growth	% old slow-growing stands	No targets	Not in BHLP
Minimise unsalvaged timber mortality	% of insect and disease damage controlled	No targets	Not in BHLP
Minimise unsalvaged timber mortality	% of natural mortality salvaged	No targets	Not in BHLP
Increase yield in enhanced timber development areas	% of ETDA thinned and pruned	No targets	BHLP 4.1a
Increase yield in enhanced timber development areas	% of ETDA commercially thinned	No targets	BHLP 4.1a
Increase yield in enhanced timber development areas	% of ETDA with improved stock	No targets	BHLP 4.1a
Maintain opportunities for tourism and recreation			
Maintain backcountry opportunities	% backcountry in primitive state	No targets ("*maintain...diverse range of...opportunities*" BHLP); Atna-Shelagyote SMZ in SRMP, but no overall targets.	BHLP 5.1a SRMP Table 13
Maintain access to recreational opportunities	# of inaccessible destinations	No target in Kispiox (BHLP: "*maintain reasonable access*")	BHLP 5.2a
Maintain and use botanical forest products			
Maintain or enhance productivity of berry habitat within berry management areas	% soil and vegetation disturbance	No target in Kispiox (objective only pertains to Kispiox)	SRMP Table 18

Appendix 4: Abbreviations

BRC ..... Babine River Corridor
BWMT ..... Babine Watershed Monitoring Trust
CFS ..... Canadian Forest Service
DFO ..... Department of Fisheries and Oceans
ECA ..... Equivalent Clearcut Area
ETD ..... Enhanced Timber Development Zones
FREP ..... Forest Resources Evaluation Program
FRPA ..... British Columbia Forest and Range Practices Act
FSP ..... Forest Sciences Program
GIS ..... Geographic Information System
LRMP ..... Land and Resource Management Plan
LUP ..... Landscape Unit Plan
MoE ..... Ministry of Environment
MFLNRO .... Ministry of Forests, Lands and Nat. Res. Ops.
MDS ..... Management Direction Statement
PEM ..... Predictive Ecosystem Mapping
SFI ..... Sustainable Forest Initiative
SFM Network ..... Sustainable Forest Management Network
SRMP ..... Sustainable Resource Management Plan
VRI ..... Vegetation Resources Inventory